Library

HONOLULU
LA JOLLA
MONTEREY
TIBURON

LIBRARY
JAN 25 1987
National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii

SOUTHWEST FISHERIES CENTER

REPORT OF ACTIVITIES SEPTEMBER-OCTOBER 1987

COASTAL FISHERIES RESOURCES DIVISION — Page

Density and Distribution of California Halibut along the Coast and in Bays and Lagoons Estimated. 1

FISHERY-MARINE MAMMAL INTERACTIONS DIVISION

Draft Status Report on Chinese River Dolphins Completed 14

HONOLULU LABORATORY

Assessment of Deepwater Shrimp Underway 18

PACIFIC FISHERIES ENVIRONMENTAL GROUP

Time Series Analysis Completed of Temperature in Upper Layers of Eastern North Pacific. 25

PELAGIC FISHERY RESOURCES DIVISION

Billfish Tracking Project Completes Second Successful Season. 29

TIBURON LABORATORY

Status of Widow Rockfish Assessed 32

INFORMATION TECHNOLOGY SERVICES

ADP Operations Changes Name to Information Technology Services. 33

NOAA/NMFS

SOUTHWEST FISHERIES CENTER

CENTER ADMINISTRATION — La Jolla, California

Center Director	*Izadore Barrett*
Deputy Director	*John F. Carr*
Planning Officer	*David J. Mackett*
Data Systems Manager	*Vacant*
Executive Officer	*Benjamin F. Remington*

LABORATORIES & DIVISIONS

Coastal Fisheries Resources Division, Chief La Jolla, California	*Reuben Lasker*
Fishery-Marine Mammal Interactions Division, Chief La Jolla, California	*Douglas P. DeMaster*
Honolulu Laboratory, Director Honolulu, Hawaii	*Richard S. Shomura*
Pelagic Fisheries Resources Division, Chief La Jolla, California	*Gary T. Sakagawa*
Pacific Fisheries Environmental Group, Chief Monterey, California	*Andrew Bakun*
Tiburon Laboratory, Director Tiburon, California	*Norman J. Abramson*

The Report of Activities of the Southwest Fisheries Center is compiled by the Technical Writing/Editing Group at La Jolla from material submitted by the Center's staff. To change the delivery address of the Report of Activities, or to cancel your subscription, please notify Jean Michalski, Editor, at P.O.Box 271, La Jolla, CA 92038. Telephone: (619) 546-7064

COASTAL FISHERIES RESOURCES DIVISION
La Jolla, California

COASTAL EASTERN PACIFIC POPULATION BIOLOGY OF FISHES

Density and Distribution of California Halibut along the Coast and in Bays and Lagoons Estimated

Biological Technician Sharon Kramer has summarized the findings of the first 8 months of a 24-month inshore fish survey conducted by the staff of the Southern California Wetland/Shallow Water Habitat Investigation. This task, established in the spring of 1986, has the following general objectives: (1) to identify species and life stages of fishes dependent upon specific habitats within southern California shallow water areas, and (2) to determine the optimal mitigation strategy when such habitats are lost because of dredging and filling.

The information here is abstracted from the current year annual report. Although data on other estuarine groundfishes are collected in the surveys, the focus in this article is on the California halibut because it is the most important fish species in southern California bays and lagoons. The surveys are conducted monthly in coastal habitats between Mission Bay and San Onofre and within Mission Bay and Agua Hedionda Lagoon. Details regarding sampling are in the annual report. Key findings for California halibut are discussed below.

Kramer found that more newly settled California halibut (SL < 50 mm) were taken during the spring quarter (April, May, June) than during the rest of the year. Density of newly settled halibut in Mission Bay increased from 28 per hectare in the first quarter to 76 in the second quarter, but was only 3-4 over the third and fourth quarters (Table 1). Because the pelagic larval period lasts about 30 days, maximum larval production probably occurs in March-April.

Only three newly settled halibut (L < 50 mm) were found along the 40 nm of coastline, whereas they were abundant in Mission Bay and Agua Hedionda Lagoon. Kramer estimated that the standing stock of newly settled halibut in the survey area in the spring quarter was about 91,000 fish; only 4% of 91,000 were estimated to occur along the open coast (Table 1). In other words, about 96% of the fish occurred in 13% of the area. The value for the coast may be misleading since juveniles between 10 mm and 80 mm were never taken on the open coast, whereas they were abundant in the bays indicating that newly settled individuals of 9-10 mm may eventually move into the bay/lagoon nursery areas. Thus, the California halibut appears to be highly dependent on bays and lagoons as nursery areas. The notion of a complete dependency of juveniles upon bays and lagoons cannot be

rejected on the basis of the observed standing stocks of juveniles. The estimate of 91,000 juveniles of about 3 months old over 40 nm of coastline seems reasonable when related to possible mortality rates, the length of coastline, and present population size.

PRELIMINARY ESTIMATE
DENSITY AND NUMBERS OF JUVENILE (SL<50mm)
CALIFORNIA HALIBUT ALONG 40nm COASTLINE
AND IN ASSOCIATED BAYS AND LAGOONS
(433 Hauls: April-June* 1987)

HABITAT TYPE	AREA Acres	AREA Hectares	Halibut Density N/Ha	Thousands of Halibut	Percentage of Total Habitat Area
Agua Hedionda					
Shore	11	4	211	1	>0.1
Open Water	285	115	168	18	1.4
All	296	119	165	19	1.5
Mission Bay					
Shore	50	20	229	5	0.2
Open Water	2,150	870	72	63	11.0
All	2,200	890	76	68	11.2
Open coast (40NM)					
6-14 Meters Deep	17,000	6,880	0.57	4	87
All Habitats	19,496	7,889	-	91	100

*Halibut density per quarter Mission Bay: 1st, 28; 2nd, 76; 3rd, 3.9; & 4th, 3.4 /Ha.

A striking feature of the distribution of newly settled halibut within Mission Bay and Agua Hedionda Lagoon was that they were most dense along the shore in very shallow water less than 1 m deep (Table 1 under "shore habitat"). The difference in density between shore and open water (1-3 m) was most pronounced in Mission Bay where density in shallow water (less than 1 m) was 3 times that found in deeper water. This trend was less pronounced in Agua Hedionda, which is a shallower and less modified estuary than Mission Bay. At the present time, the muddy, shallow-water habitat is only a small fraction of the habitat of Mission Bay, but before development of the Bay, the shallow-water habitat would have constituted a much larger fraction.

Comparison of the proportion of juvenile halibut in 20 mm length classes taken in bay and lagoon habitats and the open coast clearly indicates the length at which halibut leave bays and lagoons (Figure 1). In the bay habitats, two length modes are apparent: the larger one composed of small fish of about 1 to 10 months old, and a smaller mode of larger and older fish. The length-frequency distribution of fish taken from the open coast overlaps this second mode indicating that recruitment from bays to coastal waters begins about 150 mm and is essentially complete by the time the fish attain a length of 200 mm. Average residency of juveniles in bays and lagoons may be about 15 months since the rule of thumb for juvenile halibut growth (based on laboratory rearing work) is 10 mm/month.

These results are preliminary; only a third of the survey data has been analyzed and only half of the monthly surveys are completed. Our results may be revised when analysis is completed for the 24 monthly surveys. It should also be emphasized that the survey represents only a small portion (40 nm) of a long coastline in southern California and only two of many bay and lagoon systems. A much more extensive survey would be required to be certain that small area are correct for southern California in general. With these two caveats, Kramer's tentative conclusions are as follows: (1) California halibut are dependent upon bays and lagoons as nursery areas from settlement until about 15 months old; and (2) deep dredging and loss of shallow water mud flat habitat within bay and lagoon systems may reduce carrying capacity of nursery areas because densities are higher in shallow-water areas. (J. Hunter, FTS 895-7108)

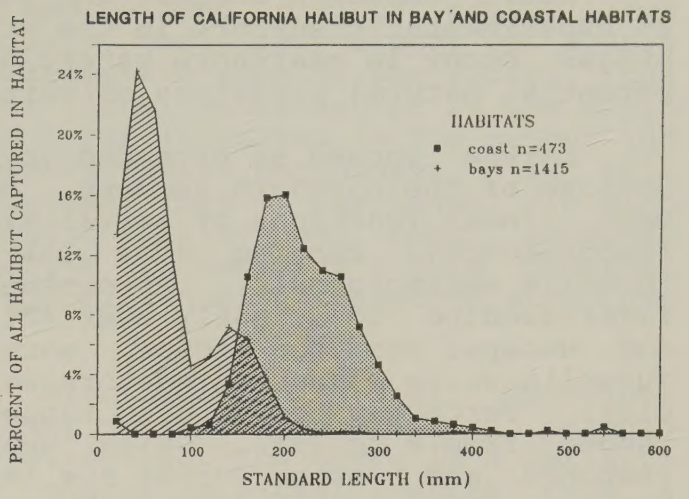


Figure 1. Percentages are calculated for 20 mm length classes number taken in the particular habitat.

Study of Larval White Seabass Completed

Dr. Dan Margulies has recently completed his one-year National Research Council postdoctoral research project at the Southwest Fisheries Center. While at the Center, Margulies examined the size-specific vulnerability to predation and development of sensory systems in larval white seabass (*Atractoscion nobilis*).

Predation is probably the most important source of mortality during pre-recruit stages for most marine species, yet the effects of fish predation on larval fishes have been largely unstudied until the last few years. Virtually nothing is known of the effects of fish predation on early life stages of the white seabass.

The objective of this study was to examine, experimentally, the size-specific vulnerability of white seabass larvae to different types of fish predators, and to determine if there is a developmental basis for any changes in larval vulnerability or behavior. The developmental studies involved vital staining and histological examination of larvae to determine the ontogeny of two sensory systems, vision and mechanoreception, which are important components of predator detection and escape responses.

Adult northern anchovy and juvenile white seabass were used as experimental predators in the study. Both of these predator stages occur in nearshore waters of southern California and are potential natural predators of white seabass larvae.

Larvae showed an extended vulnerability to the higher-speed attacks of the northern anchovy. Both responsiveness and escapes were linear functions of larval size, with mean percentage (%) responsiveness ranging from 13% at first-feeding to 55% at juvenile metamorphosis. Percentage escapes increased from 4% at first-feeding to slightly over 40% at metamorphosis. Responses and escapes from the slower, more discontinuous attacks of the juvenile white seabass predators were improved at a given larval size. Percentage responding ranged from 18 to 85%, and escapes ranged from 8 to 75%. Using juvenile white seabass predators, response and escape curves for larvae were curvilinear, with notable jumps in the functions over the larval size range of 7.5 to 9 mm, which corresponds to the early postflexion stage.

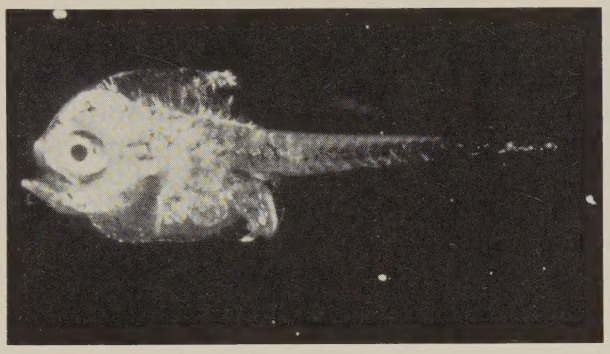


Figure 2. White seabass larva at early feeding stage, ca. 4.5 mm SL.

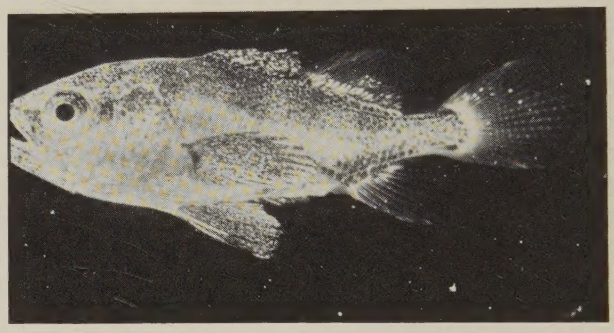


Figure 3. Late larval-early juvenile white seabass, ca. 15.0 mm SL.

During the first 1.5 to 2 weeks after hatch, white seabass larvae are rather poorly developed (Figure 2); vision is near-sighted and there is little or no accommodation to distant objects possible (the lens retractor muscle, which articulates with the lens and controls accommodation to distant objects, does not form until larvae are approximately 4.5 mm, 10 days after hatch). Predator detection at this stage must rely almost completely on a series of rather scattered free neuromasts on the head (3-4 pair) and trunk (5-6 pair). Vulnerability to predators during this stage is probably more a function of predator search capabilities and perhaps alternate prey abundance.

During the early postflexion stage (7-10 mm), larvae show a significant improvement in response and escapes from juvenile white seabass predators. This larval period corresponds to or is

preceded by a period of rapid improvement in visual acuity (from 70 to 35 min of arc on the retina), early recruitment of double cone and rod cells in the photoreceptive area of the retina, the initial development of the major visual motor center in the brain (the torus longitudinalis), and large increases in the number and patterned formations of mechanoreceptive neuromasts. At this stage, ossification of the principal rays of the caudal fin also begins, which aids in locomotor ability and burst response capability. At this time, larvae are assuming a more demersal distribution and become more associated with submerged structure or cover (Figure 3).

There appears to be a significantly higher, sustained predation risk for white seabass larvae to maintain a pelagic existence during the later larval stages, and there is a definite developmental basis for the change in larval habits from a pelagic existence to one associated with structure or bottom habitats. Although responsiveness and escapes from adult anchovy improve linearly with larval size, white seabass larvae do not appear to have the sensory and locomotory ability to efficiently respond to fast-swimming, pelagic fish predators. However, they do apparently have enough refinement in their visual, mechanoreceptive, and locomotion systems to evade slower, raptorial predators, which they are more likely to encounter in structured, vegetated or bottom habitats.

The behavior of white seabass larvae is characteristic of a number of coastal species that abandon a strictly pelagic distribution and do not school up as late larvae or very early juveniles. This change is especially important given the ontogeny of sensory development in white seabass and the fact that they are particularly robust, pigmented larvae, making them highly visible to planktivorous fish predators.

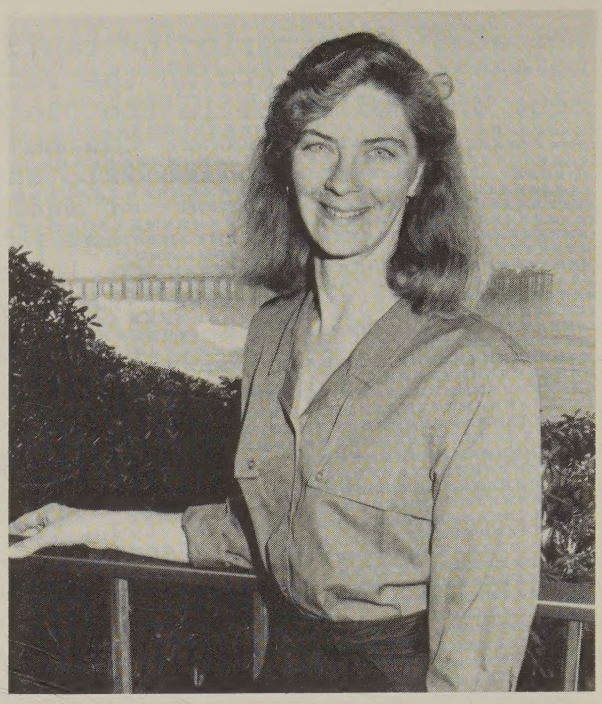
This pattern of development for white seabass also points out the importance of fast growth during the first month after hatch, which would minimize a period of obvious vulnerability to fish predation and place white seabass larvae in habitats to which they are more suited developmentally. (D. Margulies, FTS 893-7143))

New National Research Council Fellow Begins Work on Dover Sole

Dr. Mary Sue Lowery has been appointed the new National Research Council Fellow at the Southwest Fisheries Center. She plans to study changes in the biochemistry of the muscle of Dover sole (*Microstomus pacificus*), during its ontogenetic migration to deeper water. As Dover sole mature and migrate to deeper water their muscles show an increase in water content which renders them commercially undesirable. Changes in protein and nucleic

acid composition and particularly the involvement of cellular proteinases in this process will be investigated. Since many deep water fish possess high water content muscles, Lowery hopes that her research with the Dover sole will provide insights into the significance of this phenomenon to the life history and energetics of fish.

Lowery received her Ph.D. from Scripps Institution of Oceanography at the University of California at San Diego in 1987. Her doctoral research was an investigation of the effect of starvation on the protein synthesis and nucleic acid composition of muscle in the barred sand bass (*Paralabrax nebulifer*). (J. Hunter, FTS 893-7108)



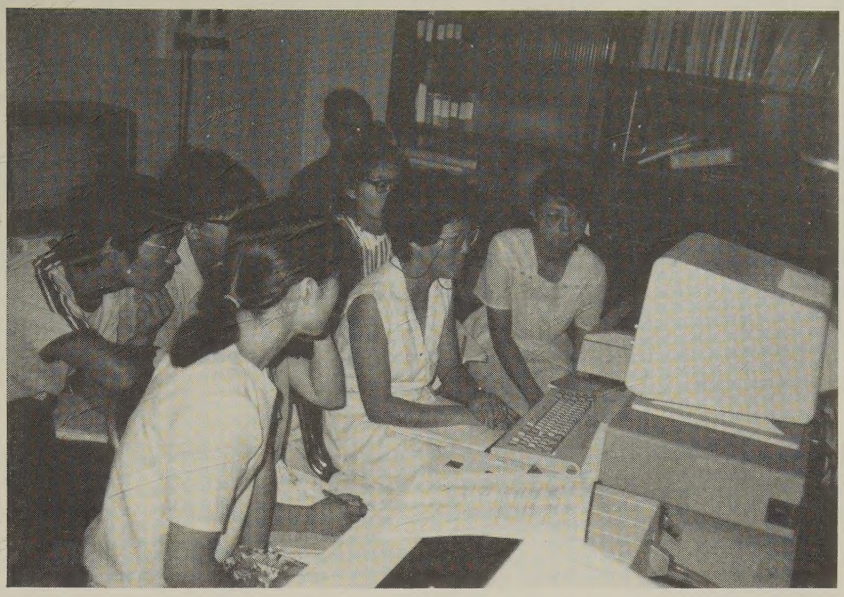
MARY SUE LOWERY

Statistical Methods Applied to Marine Biology at Tanggu Salt Research Institute, Tianjin, China

At the invitation of Tanggu Salt Research Institute at Tianjin, China, Statistician Nancy Lo spent 2 weeks at the Institute presenting a series of lectures on computer-aided statistical methods for marine biology. The Institute is under the Ministry of Light Industry and is currently conducting a 3-year research program on brine shrimp biotechnology in salt ponds to improve the quality of the salt.

Lo gave two courses: general statistical concepts and statistical methods used to analyze and model marine biology, and an introduction to two computer statistical software packages, BMDP and MINITAB. Lo presented the courses to eager researchers at the Institute who were enthusiastic to learn even though some of them had never before used a computer.

The intensive courses on statistics and computers introduced the researchers at the Institute to the necessary tools of the modern age for data analysis and provided a guide to the actual research work. Lo's two-week stay gave the researchers a glimpse at the data analysis procedures used at a U.S. research organization. (N. Lo, FTS 893-7123)



Nancy Lo teaches her class how to use statistical software to analyze data at the Tanggu Salt Research Institute, Tianjin, China

SURVEY SYSTEMS DEVELOPMENT AND EVALUATION

Micro-based System for Survey Planning and Reporting Completed for SARP Program

Computer Programmer Jim Ryan has completed a program for generating plots and station lists for navigation and station activities. The program will be used for plotting a map of stations and listing stations for the navigational plan and the scientific procedures to be completed for each station during the surveys of the Sardine-Anchovy Recruitment Program (SARP) and for reporting the results.

SARP is an international program in which scientists are testing the hypothesis that measurable physical oceanographic processes, like epipelagic mixing and transport, affect recruitment of young fishes by determining the duration and timing of that portion of the spawning season that will eventually produce survivors. For the SARP program, researchers will perform a time-space intensive survey of egg and larval production and physical measurements of the upper layers of the oceanic spawning grounds by standard procedures and then determine the birthdate distribution of the surviving juveniles and young adults some time after the conclusion of the major spawning season. To accelerate the formation of predictive measures, the SARP procedures will eventually be performed on sardine and anchovy habitats in several similar temperate ecosystems in the world. The first SARP cruise will be conducted off Spain and Portugal in 1989.

Ryan's program, which will be used in the SARP surveys, requires the input of the positions of several locations and recognizable landmarks such as cities, capes or bays on the coast to draw a recognizable coastline, and the input of the beginnings and ends of the survey lines with the direction of travel and station density. The computer will then create a cruise file. From the cruise file, it is possible to plot a map of stations, list stations for the navigational plan of the cruise, and a list of the scientific procedures to be completed on each station. After the cruise has ended, the list is edited and it becomes the final record for reporting sample and procedural results, such as stability, temperature, and salinity contours, and incidence of eggs and larvae of the target species.

The procedures used in the SARP program have been used in planning, conducting and reporting the surveys for the California Cooperative Oceanic Fisheries Investigations program and egg production cruises for the Center for the past 10 years, and they have been used by other research groups for estimating the biomass of the Peruvian anchoveta and the Pacific sardine. Until now, mapping functions for these surveys have been done mainly on the mainframe VAX at the University of California, San Diego, campus, whereas Ryan's program can be run on micros, which makes it possible for cooperating organizations to plot plans and results at their own sites with only a personal computer and plotter. Language files can be added so that the queries are in the language of the country conducting the surveys; currently only Spanish and English are implemented. (P. Smith, FTS 893-7169)

MEXUS-PACIFICO Workshop and Shakedown Cruise Conducted in Mazatlan

In further implementation of the agreements reached at the MEXUS-PACIFICO talks held between U.S. and Mexican fishery officials in La Jolla, August 10 to 11, 1987, Fishery Biologists Drs. Paul Smith and H. Geoffrey Moser, Statistician Nancy Lo, and Patricia Wolf of the California Department of Fish and Game, conducted a workshop on the egg production method from October 19 to 23, 1987, at Mazatlan, Sinaloa, Mexico. The workshop was held in preparation for a series of cruises which will be conducted by Mexican and U.S. scientists to estimate the biomass of the central stock of the northern anchovy and to document the spread of the recovering Pacific sardine northern stock.

The two committees that were established by the MEXUS-PACIFICO agreements (see July-August 1987 Report of Activities) have now made plans for the exchange of catch data and joint population analysis and for the direct estimation of spawning biomass of the sardine and anchovy. This workshop on egg production methods was the first field activity of the MEXUS-PACIFICO agreement. (P. Smith, FTS 893-7169)

New Documentation Completed for Environmental Data Mapping Program, EDMAP

EDMAP is a computer program used at SWFC to produce contour charts of oceanographic parameters from the CalCOFI data base and other sources on the UCSD VAX II-780 computer. Implementation of this program on IBM PC-AT compatible desk top computers has just been completed, along with new documentation which will be made available as an administrative report. A supplementary interactive program, EDMAPCMD, has also been implemented for PC-AT compatibles to assist users in creating command files of the parameters required to run EDMAP. (L. Eber, FTS 893-7167)

COASTAL EASTERN PACIFIC FISHERIES ENVIRONMENTAL INVESTIGATIONS

Albacore Fishing Assessed in South Pacific

Oceanographers R. Michael Laurs and Ken Bliss and Fishery Biologists Jerry Wetherall and Robert Nishimoto have completed an analysis of exploratory trolling fishing for albacore in the South Pacific. Seven U.S. fishing vessels conducted exploratory trolling fishing for albacore and made related scientific observations in the central South Pacific from January through April 1987. In addition to the U.S. fishing vessels, SWFC scientists aboard the NOAA Ship *Townsend Cromwell* conducted an oceanographic and troll fishing survey in conjunction with the fishing vessels' operations. Research vessels from New Zealand and France also participated in the albacore exploration and research investigation.

The vessels conducted exploratory fishing for albacore using standard U.S. commercial troll fishing methods. All the vessels were equipped with sea surface temperature gauges and fish sounders, and some had chromascopes to aid in locating potentially favorable fishing areas. Apart from troll fishing for albacore, fishermen also conducted albacore tag and release operations and made oceanographic observations in cooperation with SWFC scientists.

Fishing success was high in the area between 36-41°S, 135-155°W where catch rates were greater than 250 fish on 55% of the boat-days, and more than 500 fish on 33% of the boat-days. There were eight boat-days, nearly 4%, when the catch per boat was over 1,000 fish. The largest catch made in one day was 1,241 fish by the fishing vessel *Defiance*. Some fishing captains said that albacore fishing was the best they had ever experienced at any time or place.

The sizes of the albacore tuna caught ranged between 4 and 60 pounds, with 11-to-13 pound fish and 18-to-24 pound fish predominating. The overall average weight of the albacore caught by all boats for all trips was 16.4 pounds.

The survey area during the mid-January through mid-February period was characterized by sea surface temperatures ranging from 62 to 70°F, mixed-layer depths to the top of the thermocline ranging from about 100 to 150 feet, depths to the bottom of the thermocline from about 150 to 250 feet, and thermocline gradients ranging from about 3 to 8°F. The northern boundary of the Subtropical Convergence Zone (STCZ) was found between about 37°30' to 39°30'S in the region of about 155°W and appeared to bend southwestward west of 155°W. Fishing success experienced by the *Cromwell* and the fishing vessels was related to variations in the locations and strength of oceanic boundaries associated with the STCZ.

Weather conditions while the boats were traveling from California to Papeete and to the fishing grounds were generally good with light to moderate trade winds and relatively calm seas. One of the fishing vessels, the *Red Baron*, encountered some rough weather for a few days while traveling to the fishing grounds from Honolulu. Weather conditions overall were fair to good on the fishing grounds and boats lost only a few days of fishing because they were forced to drift.

The catches of albacore were sold in Papeete and averaged approximately $1,300 per short ton. Small amounts of fish were rejected by the buyer in Papeete because they were badly misshapen, broken or split and judged to be of inferior quality.

Laurs, Bliss, Wetherall, and Nishimoto conclude that prospects for establishing a U.S. troll fishery on albacore in the South Pacific appear to be excellent based on the experiences of the vessels that conducted exploratory trolling explorations. The high catch rates, high total catches and relatively good weather conditions, combined with the infrastructure in the South Pacific for selling catches and supporting vessel needs, indicate that it is economically feasible for U.S. albacore fishing vessels to operate there. They caution, however, that substantially more fishery exploration, especially in the area west of about 155°W, and knowledge of the migratory patterns and biology of the South Pacific albacore population are required to successfully develop a viable U.S. albacore surface fishery in the South Pacific. Delivering a high-quality product to the albacore fish buyers and canneries will be most important.

A detailed assessment of albacore fishing in the South Pacific can be found in SWFC Administrative Report LJ-87-22, "South Pacific albacore fishery exploration conducted by U.S. jig boats during early 1987" by R. Michael Laurs, Ken Bliss, Jerry Wetherall, and Bob Nishimoto. (M. Laurs, FTS 893-7086)

Recent Trends in Global Tuna Production and Processing Reviewed

In a report entitled "Recent Trends in Worldwide Tuna Production and Trade," Industry Economist Sam Herrick examines circumstances within the Japanese and U.S. tuna industries that have fostered the rapid expansion and development of tuna harvesting, processing, and worldwide trade during the 1980s.

Globally, the production of frozen tuna has increased rather steadily in recent years, from 1.796 million metric tons (mt) in 1980, to 2.099 million mt in 1984, an increase of 17% in 5 years (Table 1). Simultaneously, global processing of canned tuna rose from 588,000 mt to 777,000 mt, an increase of 32% (Table 2).

Table 1. World tuna production by major tuna fishing nations, (thousand metric tons, live weight) 1980-1984.

Nation	1980	1981	1982	1983	1984
Japan	723	642	674	696	788
United States	226	222	199	266	263
Spain	101	122	131	126	132
Indonesia	73	84	90	103	115
Philippines	79	95	103	119	104
France	72	69	69	84	100
Taiwan	106	90	104	104	99
Mexico	34	68	45	38	78
Rep. Korea	110	105	108	89	71
Venezuela	4	6	4	39	53
Solomon Is.	23	26	20	34	36
Maldives	28	26	20	26	32
Ecuador	19	19	21	15	29
Ghana	9	15	29	33	22
Brazil	10	24	17	17	22
Panama	21	16	25	14	20
Sri Lanka	20	21	22	23	18
Australia	14	18	21	22	16
Other	124	119	109	98	101
TOTAL	1,796	1,787	1,811	1,946	2,099

SOURCE: Food and Agriculture Organization of the United Nations, Yearbook of Fishery Statistics, Catches and Landings, 1984.

Table 2. Canned tuna producers, 1980-84 (thousand metric tons).

Nation	1980	1981	1982	1983	1984
United States	275	287	246	268	275
Japan	95	111	113	117	124
Italy	48	49	48	52	59
Thailand	*	8	15	28	59
France	25	23	30	35	38
Spain	43	40	37	37	30
Ivory Coast	18	26	29	26	23
Philippines	11	18	19	24	23
Mexico	15	20	13	11	22
Taiwan	*	14	11	15	13
Ecuador	5	12	11	7	12
Others	53	70	65	74	99
TOTAL	1,176	1,356	1,274	1,378	1,554

SOURCE: Food and Agriculture Organization of the United Nations, Yearbook of Fishery Statistics, Fisheries Commodities, 1984.

Although these increases in production and processing are impressive in themselves, perhaps more notable is the substantial development in the harvesting and processing capabilities of less developed countries relative to that of Japan and the United States, the dominant tuna producers and processors in the past. The rapid development of tuna industries in southeast Asia, Latin America, the western Pacific and Africa in most cases has been due largely to their proximity to abundant tuna resources, relatively low-cost labor sources, and active government participation. However, although these may be necessary conditions, the impetus for developing tuna industries in these areas comes from real and perceived opportunities to penetrate lucrative tuna markets in the U.S. and Japan.

In Herrick's report, conditions within the Japanese and U.S. tuna industries leading into the early 1980's are reviewed in order to gain a better understanding of how these market opportunities came into existence and, therefore, why patterns of global tuna production, processing, and trade have evolved in the way that they have. (S. Herrick, FTS 893-7111)

FISHERY-MARINE MAMMAL INTERACTIONS DIVISION
La Jolla, California

Draft Status Report on Chinese River Dolphins Completed

On December 3, 1986, NMFS received a petition from the Center for Environmental Education to list the Chinese river dolphin (*Lipotes vexillifer*), or baiji, as an endangered species on the U.S. List of Endangered and Threatened Wildlife, pursuant to Section 4 of the Endangered Species Act (ESA) of 1973. A notice was published in the Federal Register, soliciting comments and information on the status of this dolphin. Recently Drs. Robert Brownell, of the U.S. Fish and Wildlife Service, William Perrin, Senior Scientist, and Douglas P. DeMaster, Chief of the Fishery-Marine Mammal Interactions Division, completed a document summarizing what is currently known about this species. In addition to summarizing available information, the document makes recommendations as to how the recovery of this species could be expedited. The following information has been extracted from the draft report.

From the end of the 19th Century until the 1940s, the range of the baiji extended from the estuary of the Yangtze River to Yichang and even some 30 km upstream near Huanglingmiao just below the Three Gorges Region. As recently as 1955, it was found in the Qiantang River up to Fuyang County and sometimes reached Tonglu County. However, since 1974, these dolphins have been found only in the Yangtze River downstream from Zhicheng. They no longer occur in Dongting (Tungting) Lake, Hunan County, where the type specimen was collected in 1916, or the Qiantang River. The baiji is now found mainly in the middle and lower reaches of the Yangtze River (Figure 1).

The geographic distribution and hence the population size have declined drastically since the species was originally described. Work on estimation of the population size did not begin until 1979. Between 1979 and 1981, it was estimated that fewer than 400 occurred in the middle and lower reaches of the Yangtze River. The total world population currently consists of an estimated 300 individuals, of which about 100 occur in the lower reaches of the river. The population is fragmented in small groups dispersed along approximately 1600 km of river habitat. Census results suggest that the population is still declining. If the current rate of decline is not mitigated, it is unlikely that the Yangtze river dolphin population will persist for more than 20 to 50 years. This figure is based on the population continuing to decline at 5% per year and a level of incidental take of 10% per year. The estimate of persistence time was found to be quite sensitive to the level of incidental take. Additional research on the expected persistence time of the Yangtze river dolphin is underway by Chinese scientists. (D. DeMaster, FTS 893-7165).

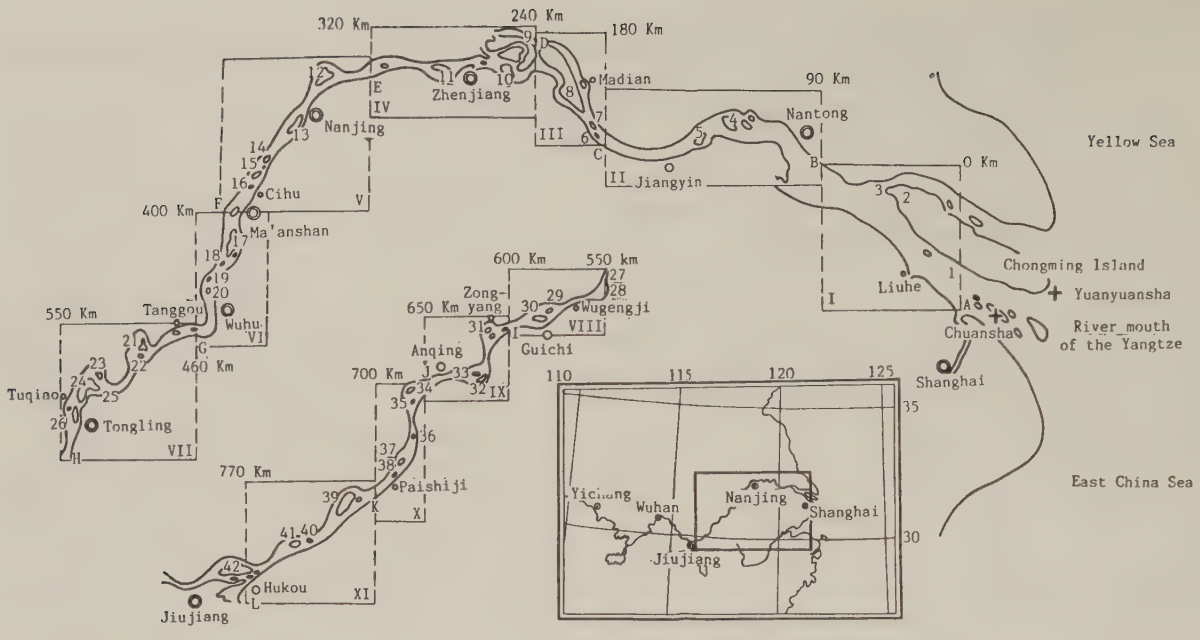


Figure 1. Range of the baiji (*Lipotes vexillifer*) in China, showing census-survey areas along the Yangtze (Changjiang) River and limits of distribution (insert). Figure from: Zhou and Li, Workshop on River Dolphins.

BIOLOGY PROGRAM

Manuscript on Dolphin mtDNA Completed

Fishery Biologist Dr. Andrew Dizon, with colleagues Drs. Sarka Southern and Peter Southern, has submitted a manuscript to the Journal of Molecular Evolution describing the cloning and characterizing of the dolphin mitochondrial DNA (mtDNA) genome.

Cloning of the mtDNA was a necessary first step in developing a molecular probe for use in Dizon's studies of the infraspecific structure ("stocks") of the exploited spinner and spotted dolphins of the eastern tropical Pacific Ocean. Characterizing the mitochondrial genome was done because of Dr. Sarka Southern's interest in the molecular evolution of extranuclear material. For the characterization study, portions of the mtDNA molecule were sequenced that included the entire D-loop region (a rapidly evolving but non-expressed portion of the genome), three t-RNA genes, and parts of the cytochrome b, URF 3, and 16S RNA genes. Comparisons with the previously characterized mitochondrial genomes from terrestrial mammals (man, mouse, and cow) indicated extensive structural and functional conservation in the coding regions of the marine mammalian genome. In the D-loop regulatory region, they identified two new blocks of conserved sequence that are present only in dolphin and cow, and they provided further evidence for the significance of sequence homology blocks that are preserved among the four mammalian

species. Their results supported the close evolutionary relationship between dolphins and even-toed ungulates (hoofed mammals including cattle, sheep, goat, pigs, camels, and hippopotamuses) with an estimated divergence time of 62 million years ago.

The cloned dolphin mitochondrial material provided and will provide in the future an invaluable tool for exploring dolphin phylogeny and evolution in the marine environment. The clones are being made available gratis to the scientific community. To date, five research groups have requested and received the cloned mtDNA. Interested researchers should contact Dizon. (A. Dizon, FTS 893-7088)

FISHERY INDEPENDENT DATA PROGRAM

Dr. Rennie S. Holt Completes Rotational Assignment

Dr. Rennie S. Holt, Operations Research Analyst, recently spent 3 months at the NMFS headquarters in Washington, D.C., on a special rotational assignment. Holt was 1 of 10 NMFS employees selected to participate in this special program designed to provide additional opportunities to broaden the scope and experience of potential management candidates.

Assigned to the protected Species Management Division of the Office of protected Resources, Holt completed a draft Biological Opinion assessing the impact of oil and gas lease sales on the endangered bowhead and gray whales in the Arctic Region. The project required coordination with the NMFS Alaska Regional Office, Minerals Management Service, NOAA General Counsel, and the North Slope Borough. The Opinion will replace existing Opinions for all previous lease sales. The major concern is the effects of oil spills and drilling operation noise on bowhead whales during their migration season.

In addition to his primary assignment, Holt also participated in meetings and reviews concerning issues on several endangered species. These included writing sections of documents to regulate importation of tuna caught in association with marine mammals by foreign nations, policy review of research and regulations of the endangered sea turtle excluder device (TED) in the U.S. shrimp fishery, progress of research to determine cause of deaths of large number of *Tursiops* along the eastern coast, review of the re-authorization of the MMPA, review of Japan's proposal to take minke whales for research, review of draft recovery plan for humpback whales, and planning meeting for research in the Antarctic. Holt also observed sessions of the House Sub-Committee to consider amendments to the Endangered Species Act.

Holt reported that the headquarters assignment provided greater insight into operations of NMFS headquarters and problems that staff in Washington, D.C. encounter. (R. Holt, FTS 893-7098)

HONOLULU LABORATORY
Honolulu, Hawaii

INSULAR RESOURCES INVESTIGATION

Assessment of Deepwater Shrimp Underway

To determine the potential of the shrimp (*Heterocarpus* spp.) fishery in the Hawaiian Islands, staff of the Insular Stock Assessment Program surveyed the stocks around the Islands of Kauai and Niihau from September 8 to October 8, 1987.

Over the last several years, assessment of deepwater fisheries for tropical pandalid shrimps has become increasingly important. An assessment of the *Heterocarpus* spp. resource in the Mariana Archipelago was made from April 1982 to August 1984 during a resource assessment of the Mariana Archipelago. Considerable potential for the *H. laevigatus* (Figure 1) stocks found on the deep slopes encircling the Hawaiian Islands was clearly demonstrated by the fishing, processing, and marketing activities of the Hawaiian Shrimp Company in 1983-1984. Since that time, a fishery for this species has continued in Hawaii, with ex-vessel prices of $3.00-4.00 per pound. In light of these developments, many Pacific island nations view with keen interest any assessment work dealing with these deepwater shrimps.

Figure 1. Shrimp (*Heterocarpus laevigatus*) captured in the waters of the Hawaiian Islands.

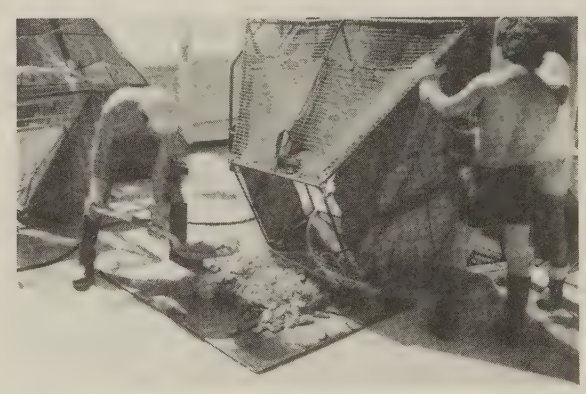


Figure 2. A large pyramidal shrimp trap and its catch of shrimp (*Heterocarpus laevigatus*).

The recent research cruise around the islands of Kauai and Niihau, which was conducted aboard the NOAA Ship *Townsend Cromwell*, is the second cruise directed at the shrimp stocks. The first cruise, in May 1986, was designed to determine the fishing power of the large pyramidal shrimp traps (Figure 2) that the Honolulu Laboratory acquired from the Hawaiian Shrimp Company upon its demise. Accordingly, an intensive fishing experiment was completed at a small (904 ha), isolated study site situated

in the Kaulakahi Channel separating the islands of Kauai and Niihau. Approximately 1.5 metric tons (t) of shrimp were removed over a 12-day period, during which catch per unit of effort (CPUE) declined from 23 to 11 kg/trap-night. Findings from this cruise were used to calibrate the catchability of the shrimp traps.

The second cruise was directed at estimating the biomass of exploitable shrimp around the islands of Kauai and Niihau. To accomplish this goal, a stratified sampling approach was taken. Ten days of the cruise were devoted to determining the depth distribution of *H. laevigatus* around these islands: The shrimp were caught between 366 and 915 m (200 and 500 fathoms), and peak levels of abundance were between 458 and 641 m (250 and 350 fathoms) (Figure 3). These results were then used during the latter part of the cruise to optimally partition sampling effort into depth strata by Neyman allocation.

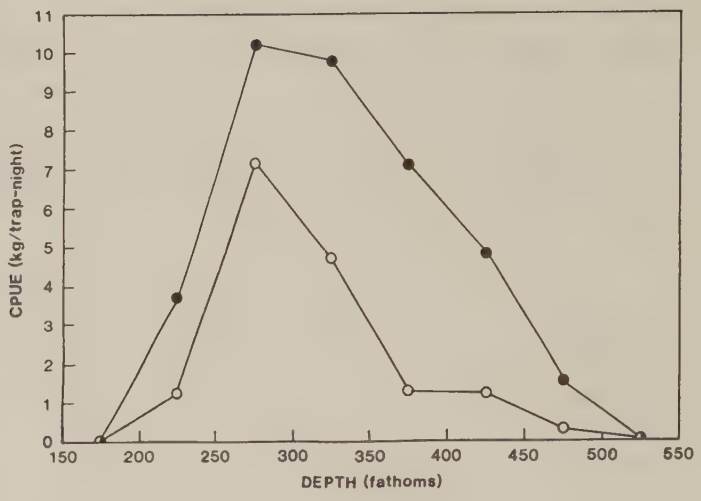


Figure 3. Catch per unit of effort (CPUE) by depth for shrimp (*Heterocarpus laevigatus*) around the islands of Niihau (square) and Kauai (asterisk).

Preliminary results summarized at the end of the cruise showed that this species is nearly twice as abundant at Niihau as at Kauai (Figure 3). Moreover, at Niihau, the overall depth distribution of shrimp was broader, and many more shrimp were taken in the deeper depth zones (641-915 m [350-500 fathoms]). Based on these initial results, the estimated standing stock of exploitable shrimp is 28 t at Kauai and 55 t at Niihau. Niihau's higher overall abundance is all the more remarkable in view of its shrimp habitat constituting only 80% of that found at Kauai.

In addition to the broad areal survey, the cruise resampled the intensive fishing site in the Kaulakahi Channel, where CPUE's had returned to the level prevailing prior to the intensive fishing experiment. Also, nearly 15,000 specimens were sexed and measured for future size structure analyses. (S. Ralston (808) 943-1259)

Pelagic Ichthyoplankton Cruise Completed

The first research cruise of the Pelagic FMP Research Program was completed on October 23, 1987 off the Waianae coast of Oahu. This cruise consisted of an ichthyoplankton survey conducted from the NOAA Ship *Townsend Cromwell* and tracking work conducted from the Honolulu Laboratory's small research boat, the *Kaahele'ale*. The objectives of this 10-day cruise were to 1) collect larvae and juveniles of pelagic management unit species to investigate their distribution in time (this period to be compared to April and September of 1988) and space (onshore-offshore), 2) collect and preserve mahimahi and wahoo larvae for use in studying date-at-hatching and growth aspects of recruitment, 3) collect oceanographic data to augment the ichthyoplankton survey and the tracking work of the *Kaahele'ale*, 4) compare the effectiveness of various ichthyoplankton sampling gear for larvae and juveniles, 5) collect ovaries of mahimahi and wahoo with known age-at-capture for aging ovarian atresia by supporting the work of the *Kaahele'ale*, and 6) conduct tracking of mahimahi or wahoo tagged with sonic tags by supporting the work of the *Kaahele'ale*.

All objectives of the cruise were met. All eight planned sites for ichthyoplankton collection were successfully sampled by using the primary plankton gear (Manta neuston net, a neuston trawl, and an Isaacs-Kidd midwater trawl). Five additional collection sites were successfully sampled as well. Two each were added along the northern and southern edges of the sampling grid, and a fifth was added 50 nmi from shore, nearly doubling the offshore extent of the survey.

To meet objective 2, all ichthyoplankton samples were preserved in alcohol to allow for examination of larval otoliths. Inspection of the catches at the time of preservation and without the aid of a microscope revealed two older wahoo larvae, but microscopic examination must be done to determine whether any mahimahi larvae were captured from the fall run.

All XBT and CTD collection sites were successfully sampled. The depth of the 20°C isotherm and the depth of the upper mixed layer were plotted against latitude and longitude during the cruise by using three-dimensional contour plotting software on a microcomputer. The perspective (Figure 4) and orthogonal plots (Figure 5) provide useful means of viewing the environmental structure relative to conducting ichthyoplankton surveys or for interpreting the results of biological sampling. In addition, three Doppler current profile transects were conducted--one along the major ichthyoplankton (east-west) transect, another with a north-south orientation along the 300-m depth contour off the Waianae coast, and the last cutting across the sampling area out to 50 nmi to one of the added ichthyoplankton stations.

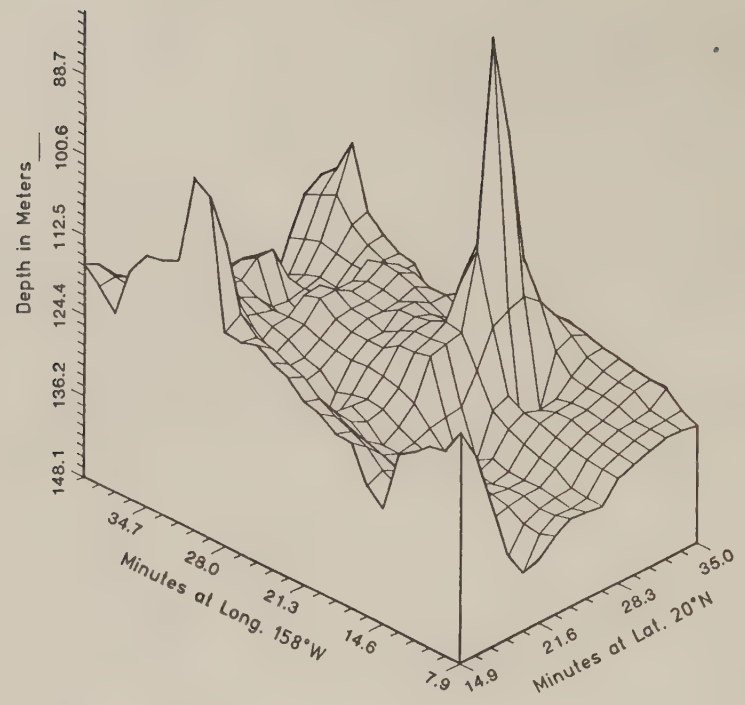


Figure 4. Depth of the 20° isotherm based on XBT profiles taken off the Waianae coast of Oahu; perspective plot at 30° viewing angle. See Figure 2 for coastline.

In comparing the effectiveness of various ichthyoplankton sampling gear for larvae and juveniles, the Manta neuston net, the neuston trawl, and the 6-ft Isaacs-Kidd midwater trawl performed satisfactorily and provided what appeared to be good samples for examination. The Tucker trawl could not be fished at the depths desired while maintaining a 45° wire angle and a reasonable ship speed; steepening the angle resulted in unpredictable opening and closing of the nets. Therefore, the net will not be used on future cruises. The Marinovich trawl appeared to fish satisfactorily based on the traces provided by the Furuno net sonde; however, catches by this gear were about one-third the volume of those for Isaacs-Kidd midwater trawl tows at the same depths

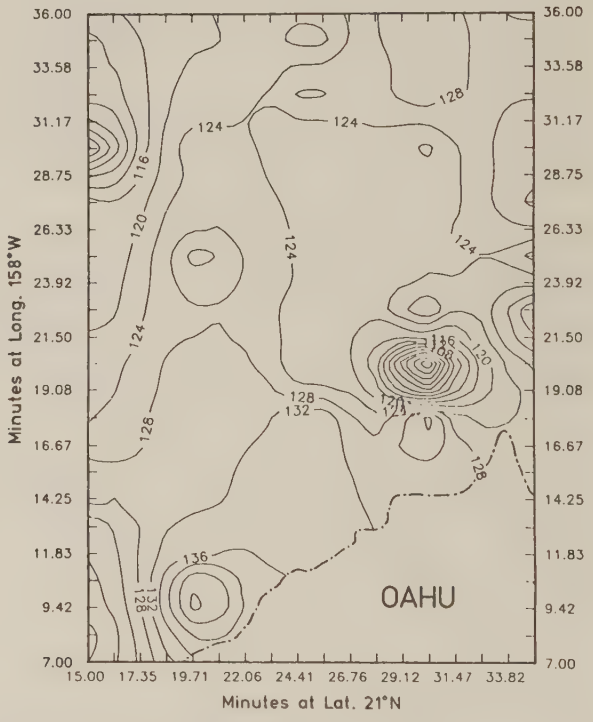


Figure 5. Depth of the 20° isotherm based on XBT profiles taken off the Waianae coast of Oahu; orthogonal plot.

and at the same stations. This gear also will not be used on future cruises unless someone determines why the trawl does not fish properly and corrects the problem.

For aging ovarian atresia, gonads from one mahimahi and several wahoo were preserved for later examination. Although no mahimahi or wahoo were tagged with sonic tags, a blue marlin, a pelagic management unit species, was tagged and tracked for about 9 hours from the *Kaahele'ale*.

Cruise participants on the *Cromwell* were Field Party Chief Robert A. Skillman, Fishery Biologist James H. Uchiyama, and Computer Programmer Charles K. Pribyl; and on the *Kaahele'ale* were Fishery Biologists Christofer H. Boggs and Randolph K. C. Chang, and NOAA Corps Officer Lt.(jg) Mark Ablondi, as well as Kim Holland and Robert Bourke, both of the University of Hawaii at Manoa. (R. Skillman (808) 943-1257)

MARINE MAMMAL AND ENDANGERED SPECIES PROGRAM

Hawaiian Monk Seal Births Increase and Juvenile Survivorship Is High

Births of Hawaiian monk seal (*Monachus schauinslandi*) pups in 1987 at the primary breeding sites in the Northwestern Hawaiian Islands (NWHI) equaled 204, the highest number since pup counts began in 1983. The 1987 births represent about a 25% increase over 1983-85; 184 pups were born in 1986. Based on current data, the mean annual survival rate of young monk seals is very high for pinnipeds: 84% from birth to age 1 and 95.7% from ages 1 to 4. Deaths due to entanglement in marine debris have been documented as part of this mortality.

Total pup counts of this species are used to monitor the status of the monk seal population and assess the effects of NMFS activities directed at recovery of the species. Estimates of total pups are determined by summing the weaned pups that are tagged, the known mortalities prior to weaning and tagging, and nursing pups that are not tagged by the end of the field season. Survival data are based on resightings of tagged seals in subsequent years. Some of these data have been summarized in the Southwest Fisheries Center Administrative Report H-87-16, "Preliminary assessment of juvenile Hawaiian monk seal survival."

Most of the increase in births has occurred at French Frigate Shoals and Pearl and Hermes Reef, the two largest multi-island atolls in the NWHI. Births at Kure Atoll were up to six in 1987, in part because of females from the NMFS Head Start project becoming reproductive. Births at Kure Atoll had slowly declined from an estimated 30 births per year in the mid-1960s to a low of 1 birth in 1986 as a result of U.S. Coast Guard beach use. As a result of the Head Start project and the introduction of female

pups from French Frigate Shoals to Kure Atoll, a trend in increased births should follow.

The increasing total number of births is a reversal in the trend apparent in the population between the late 1950s and the mid-1980s, and based on available data, current mean survival rates of juveniles are probably much higher as well. The present high survivorship of juveniles is not impeding the recovery of the species and apparently is improving the prognosis for recovery of the species. However, births at some islands are not yet recovering or are still decreasing, and the adult male "mobbing" problem, resulting in deaths of subadult and adult females, has yet to be resolved. (W. Gilmartin (808) 943-1239)

WPACFIN PROGRAM

Fishery Statistics Workshop Held in Pohnpei

David C. Hamm, Program Manager of the Western Pacific Fishery Information Network (WPACFIN), recently taught a 2-week training workshop on microcomputer applications in fisheries. The workshop, held in Kolonia, Pohnpei, Federated States of Micronesia (FSM), was sponsored by the FSM Division of Marine Resources. It was the culmination of a 2-year P.L. 88-309 project through the FSM Division of Marine Resources to establish fishery data collecting and processing systems in each of the FSM states. All FSM states are using the same data base management software as other WPACFIN island areas, thereby making their data systems WPACFIN compatible.

Daily hands-on computer training sessions were held at The Development Institute (FSM), Inc., a privately owned computer training facility and retail outlet. Each participant had an individual work station, complete with printer and necessary software and manuals. For the first 7 days of the intensive training program, Hamm took participants from an introduction to computer hardware and software through data base management systems. Special emphasis was on data base design, quality control, report generation, and proper techniques of data base processing and maintenance. The last 3 days were spent working on several island-specific applications and data bases, but concentrated on the most important data collecting and processing systems recently established under the P.L. 88-309 project. By participating in such cooperative programs, NMFS is laying the groundwork for establishing Pacific-wide fisheries data bases that will broaden our understanding of Pacific fisheries and improve our abilities to properly manage these vast resources.

Eight individuals representing six fishery-related agencies from the four states in the FSM attended. Participating agencies were the FSM Division of Marine Resources, Pohnpei Division of

Marine Resources, Micronesian Maritime Authority, Kosrae Division of Marine Resources, Truk Maritime Authority, and the Yap Fishing Authority. (D. Hamm (808) 943-1214)

Time Series Analysis Completed of Temperature in Upper Layers of Eastern North Pacific

Tom Pham, formerly of the Pacific Fisheries Environmental Group (PFEG), David Cole of PFEG, and Douglas McLain of the National Ocean Service, Monterey, recently completed a time series analysis of temperature in the upper layers of the eastern North Pacific. Monthly temperature anomalies for coastal and offshore regions were studied along the North Pacific Eastern Boundary Region from 1971 to 1987, and anomalies computed for 20 small regions spanning 3 degrees of latitude with varying longitudinal extent. These small regions were labeled 1-10 consecutively from the equator to 60°N. Both a coastal series and an offshore series were constructed to illustrate differences in duration and extent of temperature anomalies between the series. Differences were used to quantify propagation and expansion patterns of anomalous temperature throughout the region. Figures 1 and 2 show the area of data coverage for each series.

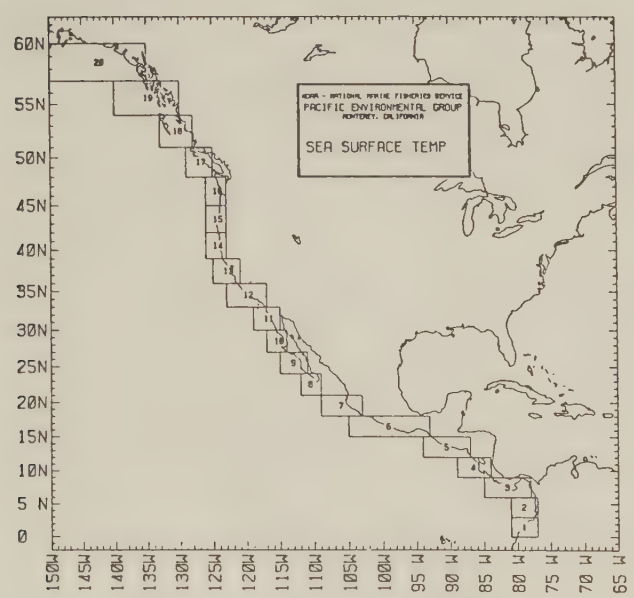


Figure 1. Coastal regions (1-20) where monthly mean sea-surface and subsurface temperatures were computed during the period 1971 to 1987.

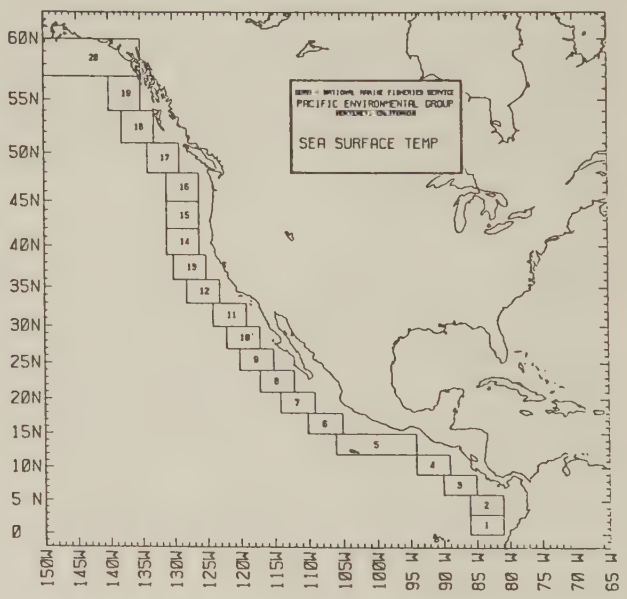


Figure 2. Offshore regions (1-20) where monthly mean sea-surface and subsurface temperatures were computed during the period 1971 to 1987.

Using data files of surface ship observations and the MOODS data set of subsurface observations (XBTs and CTDs), monthly temperature anomalies were computed for the sea surface (SST),

100 m, and 200 m depth levels. Figures 3 and 4 show monthly SST anomalies for both series. The most apparent difference between the two plots is the 1972 and 1982-83 El Niño events. In both cases, the El Niño signal is much stronger in the coastal series. Although there is evidence of a 1986-1987 El Niño in the near equatorial region, no apparent propagation is evident to the north.

Figure 3. Anomaly of monthly SST in the coastal regions during the period 1971 to 1987. Contour interval is 0.5°C.

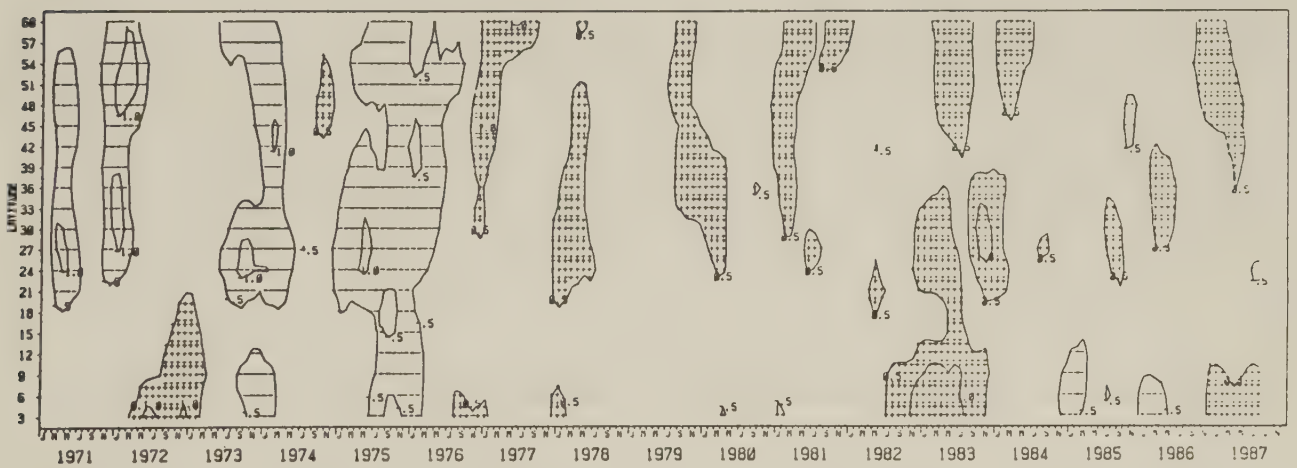


Figure 4. Anomaly of monthly SST in the offshore regions during the period 1971 to 1987. Contour interval is 0.5°C.

Plots constructed for 100 m depth levels indicate similar differences between the coastal and offshore series. The temperature anomalies at 100 m during the 1972 and 1982-1983 El Niño events are much stronger than the surface signal. Positive anomalies of up to 2-3°C are recorded during the 1982-1983 El Niño. At the 200 m depth level anomalous temperature events are not as apparent, except in the most extreme cases such as the 1972 El Niño and the 1982-1983 El Niño.

Phan, Cole and McLain noted that the patterns of monthly SST anomalies suggest a cutoff region between 12°N and 18°N, where the poleward propagation of the El Niño signal may be influenced by other processes. Seasonal processes such as local heating and upwelling become strong influences north of this region. El Niño events become dominant factors south of this region. The researchers suggest that an El Niño event must contain a sufficient positive temperature signal to propagate northward past this region into the mid-latitudes.(D. Cole (408) 646-3311)

PELAGIC FISHERY RESOURCES DIVISION
La Jolla, California

MULTISPECIES DATA COLLECTION AND EVALUATION PROGRAM

Tuna Data Bases Developed

Al Coan, Supervisory Mathematical Statistician, and Aaron Weinfield, Computer Programmer, have created two new data systems. The first data system contains yearly catch data by FAO areas for tuna and tuna-like fishes, billfishes and sharks from the Indian, Pacific and Atlantic Oceans. The source of the data is the FAO Yearbook of Fishery Statistics, supplied by Dick Schween of NMFS in Washington, D.C. Some of the data have been modified to include gear designations obtained from Indo-Pacific Tuna Development and Management Programme Data Summaries. The system currently contains data for 1970 to 1985 and will be updated yearly. The data are stored on a PC/AT clone using the commercial data base management package FOXBASE, a compiler for Dbase III programs. ASCII files can also be generated.

The second system contains data for purse seiners fishing in the western Indian Ocean. Data include monthly catches of yellowfin and skipjack tunas, fishing effort in days fishing and number of vessels and catch-per-unit effort. The data source is the Seychelles Fishing Authority Tuna Bulletin. The system currently contains data for 1983 through the second quarter of 1987 and new data will be added as they are received. The data are stored on an IBM PC/AT clone using the commercial package LOTUS, and can be transferred to ASCII files. Both data bases will be used for stock assessment analyses by other researchers in the Pelagic Fisheries Resources Division. (Al Coan, FTS 546-7079)

STOCK ASSESSMENT AND FISHERY IMPACT ANALYSIS PROGRAM

Development of Archival Tag Promoted for Fish Tagging

Fishery Biologist Dr. Pierre Kleiber has been promoting the development of the archival tag for tagging fish. The tags used currently can tell researchers where the fish began and ended its journey, but it tells little about the route the fish took. The archival tag, which is one of the ideas that arose from a series of meetings on tuna movements held at the Southwest Fisheries Center in 1985, would be small enough to be carried by a moderate-sized fish (about the size of a skipjack tuna), and would be smart enough to record environmental information that

would allow researchers to infer the course the tagged fish followed.

Northwest Marine Technology, Inc. (NWMT) completed a study of the technical feasibility of the tag supported by Small Business Innovations Research, and on the basis of the favorable results of that study, qualified for further support to cover a part of the cost of development and manufacture of prototype tags. However, a market survey was conducted shortly after the technical feasibility study with the result that the archival tag was found to be commercially non-viable at the projected price of approximately $2000 each. NWMT is therefore unable to continue development of the tag because it would have to look to the marketplace to recoup its own projected investment in the tag.

Though the tag may not be commercially viable, it is still scientifically and technically viable. Dr. Pierre Kleiber, assistant COTR for the technical feasibility study, has contacted persons who attended the tuna movement meetings or otherwise expressed interest in the archive tag idea. He did so in the hope that others with the resources to tackle development of the tag might be encouraged to do so. He has received some serious responses, both locally and abroad, and is now investigating the possibility of forming an international consortium to further the development of the archival tag. (P. Kleiber, FTS 893-7076)

Tuna Vessel Observer Data Model Under Development

Fishery Biologists Drs. Elizabeth Vetter and Pierre Kleiber are collaborating to produce a model that will simulate the manifestly non-random movement of fishing vessels as they search for tuna with the aid of dolphin schools. The model will be able to incorporate various degrees of non-randomness in the distribution of fish and dolphin schools as well as various types of communication between tuna vessels. The model will produce simulated tuna vessel observer data, which will be subjected to the same kinds of analyses used with real observer data to estimate indices of dolphin abundance. The difference is that the ground truth of dolphin abundance will be well known in the case of the simulated data and is unknown or poorly known in the case of the real data. The model will therefore be useful for investigating the robustness of dolphin abundance analyses to biases inherent in the non-random encounters between tuna vessels and dolphin schools. (P. Kleiber, FTS 893-7076)

Billfish Tracking Project Completes Second Successful Season

Billfish fishing in southern California has increased steadily during the last decade. In 1986, staff from the Southwest Fisheries Center and the California Department of Fish

and Game (CDF&G) began a cooperative research project to monitor the short-term movements of the striped marlin (*Tetrapturus audax*). These studies use acoustic telemetry to identify daily behavior patterns of billfish and to determine their availability and vulnerability to both recreational and commercial fishing gears. Fishery Biologists David Holts and Earl Weber recently completed a second successful season tracking striped marlin in the southern California Bight, in cooperation with colleagues from CDF&G.

In 1986, one striped marlin and one swordfish (*Xiphias gladius*) were tracked for 24 hours each. This year, nine striped marlin were tagged, and six of these were tracked for 20 to 48 hours. The total tracking time was 180 hours and covered 201 miles. Several behavior patterns are beginning to emerge from this acoustic telemetry data.

Preliminary results indicate the swimming patterns, activity levels and diel behavior of striped marlin differ greatly from that of the swordfish and tuna. The striped marlin spent nearly 80% of the time tracked in less than 20 m of water and only occasionally descended below 80 m. None of the marlin tracked thus far have descended below 90 meters (300 feet). The marlin tended to travel greater distances in the afternoons and evenings than during the night time. Two of the marlin were observed feeding the morning after tagging and another was observed "finning" with three untagged marlin. Generally they tended to swim up-swell (into the wind and swell) in the late morning and early afternoons but turned down-swell and were observed "tailing" down swell in the afternoon. They also tended to swim faster and in a more continuous direction than the swordfish tracked last year. The swordfish spent considerable time at depths over 1000 feet. These dives were marked by abrupt changes in depth, which induces tremendous physiological stress from changes in water temperature, pressure and dissolved oxygen content.

One additional aspect of this research is the positive indication that striped marlin can be caught, fought, tagged and released without serious injury. They appear to recover rapidly from the trauma of capture and several have been seen feeding and schooling with other marlin within 15 hours of tagging. (D. Holts, FTS 893-7186)

TIBURON LABORATORY

Tiburon, California

GROUNDFISH PHYSIOLOGICAL ECOLOGY INVESTIGATION

Cruises to the Cordell Bank Provide Research Opportunities for Other Investigators

For over 2-1/2 years, researchers of the Groundfish Physiological Ecology Investigation have conducted monthly charter cruises to Cordell Bank, a submerged seamount 2.5 miles off northern California. During these charters, adult rockfish (*Sebastes* spp.) specimens are collected as part of a study of the physiological conditions and reproductive biology of rockfishes. Apart from an annual, private expedition to Cordell Bank by divers, the NMFS cruises are the only regularly scheduled scientific expeditions to the Cordell Bank area. To encourage cooperative research on fishery-related problems, staff of the Groundfish Physiological Ecology Investigation have provided research opportunities to students and researchers from nearby universities and other tasks at the Tiburon Laboratory.

Drs. Norm Haard and David Reid of the Department of Food Science and Technology, University of California at Davis, have been collecting various *Sebastes* species for biochemical studies of muscle deterioration in fish prepared and stored in different manners. The information generated in this research complements research conducted by the Groundfish Physiological Ecology Investigation researchers on serum nutrients and proximate analyses of rockfish tissues.

Two graduate students, John Andurs from San Francisco State University and Jordan Gold from the University of California Bodega Marine Laboratory, are completing a year's study of the male reproductive biology of yellowtail rockfish (*Sebastes flavidus*). Their in-depth studies on the structural and functional morphology of the male reproductive system have paralleled studies of female reproduction by staff of the Groundfish Physiological Ecology Investigation.

Fishery biologists from the Groundfish Communities Investigation at the Tiburon Laboratory who are working on determining the age and growth of lingcod (*Ophiodon elongatus*) also benefit from the cruises because lingcod are collected along with the rockfish. The lingcod are measured, tagged, injected with oxytetracycline, and released as part of this study.

Researcher Mike Eldridge noted that only through such cooperative activities is it possible to make more efficient use of research funding and explore new ideas and to answer some of

the related questions that emerge from the laboratory's main research. (M. Eldridge, FTS 556-0565)

GROUNDFISH ANALYSIS INVESTIGATION

Status of Widow Rockfish Stock Assessed

Fishery Biologists Joseph Hightower and William Lenarz have completed a report on the status of the widow rockfish fishery for the Pacific Fishery Management Council. The report contains an analysis of catch-at-age data collected during port sampling from 1980 through 1986.

Hightower and Lenarz used cohort analysis and catch-at-age analysis (a nonlinear least-squares approach) to estimate population size and fishing mortality rates. By using two stock reconstruction techniques, they obtained some indication of the sensitivity of the results to the assumptions required for each method.

The two approaches generally gave similar estimates of population size and fishing mortality rates. Both approaches indicate that projected stock biomass in 1988 and 1989 should be slightly lower than the estimated levels in 1985 and 1986. Using results of cohort analysis, Hightower and Lenarz found that average yield in 1988 and 1989 (an estimate of Acceptable Biological Catch [ABC]) at the recommended fishing mortality rate (0.30) would be 12,500 metric tons (mt). Using results of catch-at-age analysis, the estimated ABC would be 11,700 mt. Because each of the two stock reconstruction techniques has advantages and disadvantages, Hightower and Lenarz recommended calculating ABC as the average of the two ABC estimates. This combined estimate of the 1988 ABC was 12,100 mt.

The report has been accepted by the Groundfish Management Team and is included in "Status of the Pacific Coast Groundfish Fishery Through 1987 and Recommended Acceptable Biological Catches for 198," which is published annually by the Pacific Fishery Management Council. (J. Hightower, FTS 556-0565)

INFORMATION TECHNOLOGY SERVICES

ADP Operations Changes Name to Information Technology Services

Director Izadore Barrett has approved the name change of Fisheries Information Systems and ADP to Information Technology Services (ITS). The new name, which is effective October 1, is more descriptive of the services provided by this group. ITS serves as advisor for the Director's Office and as a service unit for the La Jolla Laboratory. Some of the functions include recommending cost-effective utilization of state of the art computer hardware and software which would best meet the Center's and Region's needs, managing and maintaining multi-user microsystems and communication network, and providing consulting and training services on hardware and software implemented on in-house and contracted computer systems. (D. Roll, FTS 893-7057)

New SWFC ADP Procurement Policy Effective October 1

During Fiscal Year 1987, the Inspector General's Office reviewed the SWFC's ADP procurement practices and cited the Center's need to pool requests for discounts on volume purchase. To conform to the recommendations made by the Inspector General's Office, new procedures and a schedule for the procurement of ADP equipment, software and services were developed. The new policy became effective October 1.

Information on policy and detailed procedures has been distributed to the SWFC staff. In brief, the general policy states that the description for the requested equipment specifies the physical and functional characteristics of the equipment. Requests for equipment by manufacturer, make, and model will not be accepted. Procurement requests will be held in a pending file for processing on a periodic schedule. Orders for hardware, software, and hardware/software upgrades will be consolidated monthly to obtain the most advantageous price. Orders for personal computers will be consolidated and processed every 2 months. Purchases of personal computers are scheduled for the first of November, January, March, May, July, and September. Emergency purchases will be considered, but they must be fully justified in writing and approved by designated officials. Forth-quarter procurements will follow the existing DoC regulations. (D. Roll, FTS 893-7057)

STATUS OF PUBLICATIONS

Published

Ambrose, David A., Richard L. Charter, H. G. Moser, and Celeste R. Santos Methot. 1987. Ichthyoplankton and station data for California Cooperative Oceanic Fisheries Investigations survey cruises in 1951. NOAA-TM-NMFS-SWFC-79, 196 p.

This report provides ichthyoplankton and associated station and tow data from California Cooperative Oceanic Fisheries Investigations (CalCOFI) cruises conducted off California and Baja California in 1951. It is the first report in a series that presents these data for all biological-oceanographic CalCOFI surveys from 1951 to the present. A total of 1368 stations were occupied during 12 monthly multivessel cruises over the quarter-million square mile survey area which extends from the California-Oregon border to Cape San Lucas, Mexico and seaward to several hundred miles. The data are listed in a series of 6 tables; the background, methodology, and information necessary for interpretation and quantitative analysis of the data are presented in an accompanying text. All pertinent station and tow data, including volumes of water strained and standard haul factors are listed in the first table. Another key table lists, by station and month, standardized counts of each of the 134 larval fish taxa identified from survey samples. This and subsequent reports will make the CalCOFI ichthyoplankton and station data available to all investigators and will serve as guides to the newly developed computer data base.

Boehlert, G. W., and B. C. Mundy. 1987. Recruitment dynamics of metamorphosing English sole, *Parophrys vetulus*, to Yaquina Bay, Oregon. Estuarine Coastal Shelf Sci. 25:261-282.

English sole, *Parophrys vetulus*, spawn in shelf waters off the west coast of North America and early development occurs in coastal waters. Near metamorphosis, however, larvae recruit to nearshore and estuarine nursery areas, an uncommon life-history feature for species in this region. Recruitment of larval *P. vetulus* to Yaquina Bay, Oregon, was sampled with moored nets on a weekly basis. Recruitment began during night flood tides in late February and was characterized by three peaks during the season. Planktonic recruitment continued into June, whereas benthic juveniles began to emigrate from the estuary in late May.

The data suggest that two developmental stages of recruits immigrated to Yaquina Bay. The first are newly transforming larvae which enter the bay earliest within each peak of recruitment; peaks of abundance are related to onshore Ekman

transport. This transport also brings larvae to shallow areas along the open coast where they settle. These transforming stages are still capable of pelagic swimming activity and continue to recruit to the estuary, typically swimming deeper in the water column than the early stages. Estuarine factors, particularly bottom salinity at the end of ebb tide, are most strongly correlated with recruitment of these stages. It seems that tidal stream transport is the primary mechanism used by English sole to recruit to the estuary, but the mechanism of locating the estuary and timing of entry is relatively complex.

Bourke, R. E., J. Brock, and R. M. Nakamura. 1987. A study of delayed capture mortality syndrome in skipjack tuna, *Katsuwonus pelamis* (L). J. Fish Dis. 10:275-287.

This study was initiated to determine the cause(s) of delayed mortality in newly captured skipjack tuna, *Katsuwonus pelamis* (L.), being held at the National Marine Fisheries Service Kewalo Research Facility. Sixty-four percent of 244 skipjack tuna delivered to the facility died, usually on the second or third day after capture. The capture history, morphological data, serum chemistry (21 standard parameters), haematology, and histological samples of major organs, were obtained from 30 fish sampled at sea immediately after capture, or after approximately 4, 9, 24, 48 or 500+h in captivity. The cause(s) of death in these fish could not be attributed to anoxia, disseminated intravascular coagulation, lactic acidosis, capture myopathy or infection. Post-capture haemodilution is hypothesized as a major factor of delayed capture mortality syndrome in skipjack tuna.

Gilpatrick, J. W., Jr., W. F. Perrin, S. Leatherwood and L. Shiroma. 1987. Summary of distribution records of the spinner dolphin, *Stenella longirostris*, and the pantropical spotted dolphin, *S. attenuata*, from the western Pacific Ocean, Indian Ocean and Red Sea. NOAA-TM-NMFS-SWFC-89, 11 p.

Kleiber, P., A. W. Argue, and R. E. Kearney. 1987. Assessment of Pacific skipjack tuna (*Katsuwonus pelamis*) resources by estimating standing stock and components of population turnover from tagging data. Can. J. Fish. Aquat. Sci. 44:1122-1134.

More than 140,000 tagged skipjack tuna (*Katsuwonus pelamis*) were released during 3 yr over a large portion of the central and western Pacific. Tag returns exceeded 6000. We developed a set of tag attrition models to analyze tag release and return data and catch and effort statistics for the study area. We used these models to assess the status of the skipjack resource in the whole study area and within subdivisions thereof. Total standing stock was estimated at 3 million metric tons (Mt), (95% confidence range 2.5-3.7

Mt). Overall attrition rate (including losses to natural mortality, fishing mortality and emigration) was 0.17·mo^{-1} (0.15-0.20·mo^{-1}). Total throughput was estimated at 6.2 Mt·yr^{-1}) compared with catch of < 0.3 Mt·yr^{-1}. Overall harvest ratio was 0.04. Harvest ratios for seven subareas for which detailed catch and effort statistics were available ranged from 0.02 to 0.46; only one exceeded 0.17. Low harvest ratios over most of the study area during the period tags were at large imply a potential for increased skipjack catches in many subareas and in the whole study area.

Moffitt, R. B., and J. J. Polovina. 1987. Distribution and yield of the deepwater shrimp Heterocarpus resource in the Marianas. Fish. Bull., U.S. 85:339-349.

A shrimp trapping survey was conducted at 22 islands and banks in the Mariana Archipelago during a 2-year field period. Three species of deepwater shrimp were found in abundance at various depths: *Heterocarpus ensifer* at 366-550 m, *H. laevigatus* at 550-915 m, *H. longirostris* >915 m. *Heterocarpus laevigatus* was the largest and most abundant of the three and has the greatest economic potential. Estimates of the unexploited biomass of this species by bank were calculated from estimates of catchability, relative abundance, and habitat area. An archipelago average of the unexploited trappable biomass was estimated to be 0.8 t/nmi^2. Evaluation of length-frequency distributions produced estimates of asympototic length (L) of 55 mm carapace length, instantaneous growth constant (K) of 0.3 yr^{-1}, and instantaneous total mortality (Z) of 0.75 yr^{-1}. A recommended yield of 162.0 t/year (0.2 t/nmi^2 per year) for the entire archipelago was calculated using the Beverton and Holt yield-per-recruit equation based on minimum spawning stock considerations. Of this yield, 85% would come from the southern islands (e.g., Guam and Saipan), 13% from the northern islands (e.g., Pagan and Anatahan), and 2% from the western seamounts (e.g., Arakane Reef and Pathfinder Reef.

Translations

Suzuki, T. 1985. Food qualities of the tuna (Shokubutsu To Shite No Sakana...Maguro-Katsuo Wo Chusin Ni). Report of the Fiscal Year 1984 Japan Tuna Fishery Research Conference (Maguro Gyogyo Kenkyu Kyogikai Hokokusho). A special report. Japan Fisheries Agency, Far Seas Fisheries Research Laboratory, p. 1-7. (Engl. transl. by T. Otsu, 1987, 13 p., Transl. No. 116; available Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396.)

Komrakov, O. E. 1970. Distribution and fishery of the boarfish (*Pentaceros richardsoni* Smith) in the Hawaiian region. In the collection: The present state of biological

productivity and the volume of biological resources of the world ocean and prospects for their utilization. Kaliningrad, p. 155-163. (Engl. transl. by W. G. Van Campen, 1987, 9 p., Transl. No. 117; available Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396.)

Japan Marine Fishery Resource Research Center. 1986. Japan Marine Fishery Resource Research Center Fishery Symposium. Japan Marine Fishery Resource Research Center (JAMARC) 31:63-73. (Engl. transl. by T. Otsu, 1987, 18 p., Transl. No. 118; available Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396.)

Approved by Center Director

Barlow, Jay. Harbor porpoise (*Phocoena phocoena*) abundance estimation based on ship surveys in California, Oregon and Washington. For consideration for publication in Fishery Bulletin, U.S.

Barlow, Jay, Chuck Oliver, Terry D. Jackson, and Barbara L. Taylor. Harbor porpoise (*Phocoena phocoena*) population density estimates based on aerial surveys in California, Oregon and Washington. For consideration for publication in Fishery Bulletin, U.S.

Boehlert, George W. and Takashi Sasaki. Pelagic biogeography of the armorhead, *Pseudopentaceros wheeleri*, in the North Pacific Ocean. For consideration for publication in Fishery Bulletin, U.S.

Emerson, William K. and Robert B. Moffitt. A new genus and species of prosobranch gastropod from the Mariana Islands. For consideration for publication in Veliger.

Norton, Jerrold G., Douglas R. McLain, David M. Husby and Russell E. Brainard. Differentiation of ocean warming events dependent on downward propagation of El Niño internal waves. For consideration for publication in Science.

Olney, John E. and George Boehlert. Spawning and recruitment of fishes associated with seagrass beds in the lower Chesapeake Bay. For consideration for publication in Marine Ecology Progress Series.

Owen, Robert W. Microscale variations of small plankton in coastal and pelagic environments. For consideration for publication in the Journal of Marine Research.

Perrin, William F. (editor). Action plan for conservation of dolphins, porpoises and whales: 1988-1992. Book to be published by IUCN.

Perrin, William F., Stephen Leatherwood and Anne Collet. Fraser's dolphin *Lagenodelphis hosei* Fraser, 1956. For publication in the Handbook of Marine Mammals.

Polovina, Jeffrey J. Density dependency in spiny lobster, *Panulirus marginatus*, in the Northwestern Hawaiian Islands. For consideration for publication in the Canadian Journal of Fisheries and Aquatic Sciences.

Southern, Sarka O., Peter J. Southern, and Andrew E. Dizon. Molecular characterization of a cloned dolphin mitochondrial genome. For consideration for publication in the Journal of Molecular Evolution.

Administrative Reports

Gilmartin, W. G., T. C. Johanos, and T. Gerrodette. 1987. Preliminary assessment of juvenile Hawaiian monk seal survival. Natl. Mar. Fish. Serv., NOAA, Honolulu, HI. Southwest Fish. Cent. Admin. Rep. H-87-16, 11 p.

Korson, Charles S. and Cynthia J. Thomson. A report on the PACFIN research data base for 1985. SWFC Admin. Rep. LJ-87-21, 16 p.

Oliver, Charles W. and Mark S. Lowry. 1987. Pinniped studies conducted between August, 1981 and December, 1982 San Clemente Island, California. SWFC Admin. Rep. LJ-87-23, 17 p.

Samples, K. C., and J. T. Sproul. 1987. Potential gains in fleet profitability from limiting entry into the Northwestern Hawaiian Island commercial lobster trap fishery. Natl. Mar. Fish. Serv., NOAA, Honolulu, HI. Southwest Fish. Cent. Admin. Rep. H-87-17C, 30 p.

UNITED STATES
DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
SOUTHWEST FISHERIES CENTER
8604 LA JOLLA SHORES DRIVE
P.O. BOX 271
LA JOLLA, CALIFORNIA 92038

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE, $300

AN EQUAL OPPORTUNITY EMPLOYER

POSTAGE AND FEES PAID
DEPARTMENT OF COMMERCE
210

U.S.MAIL®

THIRD CLASS